

**Claims**

1. (Currently amended) A nanoreactor, comprising:  
a nanoreactor shell having a thickness of at least 0.5 nm,  
said nanoreactor shell enveloping ~~ana~~ space, wherein,  
said nanoreactor shell is not perfectly single crystalline, further comprising  
a nanoparticle disposed within the space, wherein the nanoparticle is not a  
metal-chalcogenide semiconductor.
2. (Original) The nanoreactor as claimed in claim 1, wherein:  
the shell thickness is between about .5 nm and 100 nm.
3. (Original) The nanoreactor as claimed in claim 2, wherein:  
the shell thickness is between about 2 nm and 80 nm.
4. (Original) The nanoreactor as claimed in claim 3, wherein:  
the shell thickness is between about 3 nm and 10 nm.
5. (Original) The nanoreactor as claimed in claim 1, wherein:  
the shell comprises a material selected from the group consisting of Pt, ZnS,  
ZnSe, ZnTe, ZnO, CoO, Co<sub>3</sub>O<sub>4</sub>, Fe<sub>2</sub>O<sub>3</sub>, FeP, Fe<sub>3</sub>O<sub>4</sub>, FeO, TiO<sub>2</sub>, CdS,  
CdSe, CdTe, HgS, HgSe, HgTe, MgTe, GaN, GaP, GaAs, GaSb, InN,  
InP, InAs, InSb, AlAs, AlP, AlSb, AlS, Co<sub>9</sub>S<sub>8</sub>, Co<sub>3</sub>S<sub>4</sub>, CoSe, GaMnAs,  
GaInN and InAsN.
6. (Original) The nanoreactor as claimed in claim 1, wherein:  
the shell comprises a material selected from the group consisting of Co<sub>9</sub>S<sub>8</sub>,  
Co<sub>3</sub>S<sub>4</sub>, CoO, Co<sub>3</sub>O<sub>4</sub>, CoSe, CdS, Fe<sub>2</sub>O<sub>3</sub>, CdSe and Pt.
7. (Currently amended) The nanoreactor as claimed in claim 5, wherein:  
the shape of the nanoreactor is ~~either spherical, branched, tubular or disk.~~

8. (Original) The nanoreactor as claimed in claim 7, wherein:  
the shape of the nanoreactor is spherical, and  
the outside diameter is between about 1 nm and 1000 nm.
9. (Original) The nanoreactor as claimed in claim 8, wherein:  
the outside diameter is between 1 nm and 500 nm.
10. (Original) The nanoreactor as claimed in claim 9, wherein:  
the outside diameter is between 5 nm and 100 nm.
11. (Original) The nanoreactor as claimed in claim 10, wherein:  
the outside diameter is between 10 nm and 50 nm.
12. (Original) The nanoreactor as claimed in claim 11, wherein:  
the outside diameter is between 10 nm and 30 nm.
13. (Original) The nanoreactor as claimed in claim 1, wherein:  
the nanoreactor shell comprises a binary or ternary compound, wherein said  
binary and/or ternary compound comprises a first material and a second  
material, wherein:  
the first material comprises a material selected from the group consisting  
of Pt, Zn, Co, Fe, Ti, Cd, Hg, Mg, Ga, In, Al, Ni, Sn and Bi; and  
the second material is selected from the group consisting of S, Se, O, P, N,  
F, Cl, I, Br, As and Sb.
14. (Original) The nanoreactor as claimed in claim 13, wherein:  
the diffusion rate for the first material is different than the diffusion rate for  
the second material.
15. (Original) The nanoreactor as claimed in claim 7, wherein:  
the nanoreactor shell has a disk shape, and

the outside diameter is between about 10 nm to about 200 nm.

16. (Original) The nanoreactor as claimed in claim 15, wherein:  
the outside diameter is between about 10 nm and 100 nm.
17. (Original) The nanoreactor as claimed in claim 15, wherein:  
the outside diameter is between about 25 nm and 50 nm.
18. (Currently amended) The nanoreactor as claimed in claim 7, wherein:  
the nanoreactor has a tubular shape, and  
~~the~~ a length of the tubular shape is between about 30 nm to about 500  $\mu$ m.
19. (Original) The nanoreactor as claimed in claim 18, wherein:  
the length is between about 50 nm and 200  $\mu$ m.
20. (Original) The nanoreactor as claimed in claim 19, wherein:  
the length is between about 50 nm and 20  $\mu$ m.
21. (Currently amended) A method of making a nanoreactor, comprising  
providing a nanoparticle,  
coating the nanoparticle with a first material,  
reacting the first material with a second material,  
wherein the first and second material react to form a nanoreactor shell that envelopes a space within which encasing the nanoparticle is disposed.
22. (Currently amended) ~~A~~ The method of making a nanoreactor as claimed in claim 21, wherein:  
the first material comprises a material chosen from the group consisting of Al, Ga, In, Tl, Sn, Pb, Bi, Po, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, Cd, La, Hf, Ta, W, Re, Os, Ir, Pt, Au, Hg, Li, Na, K, Rb, Cs, Be, Mg, Ca, Sr, Ba, Ge, Si, Se, Te, FeCo, CoNi and CdZn.

23. (Currently amended) ~~A~~The method of making a nanoreactor as claimed in claim 21, wherein:
- the second material comprises a material chosen from the group consisting of S, O, Se, Te, P, N, As, Cl, I, Br and Bi.
24. (Currently amended) ~~A~~The method of making a nanoreactor as claimed in claim 23, wherein:
- the second material comprises a material chosen from the group consisting of S, O, Se and Te.
25. (Currently amended) ~~A~~The method of making a nanoreactor as claimed in claim 21, wherein:
- the second material comprises sulfur in solution, and
- the second material is combined with a solution containing the first material to make a sulfide nanoreactor.
26. (Currently amended) ~~A~~The method of making a nanoreactor as claimed in claim 21, wherein:
- the second material comprises O, and
- a gaseous mixture containing the second material is combined with a solution containing the first material,
- thereby making a oxide nanoreactor compound.
27. (Currently amended) ~~A~~The method of making a nanoreactor as claimed in claim 21, wherein:
- the second material comprises O, and
- and the second material is in solution and is combined with a solution containing the first material,
- thereby making an oxide nanoreactor compound.

28. (Currently amended) The nanoreactor as claimed in claim 1, wherein:  
the nanoparticle comprises a material selected from the group consisting of  
Al, Ga, In, Tl, Sn, Pb, Bi, ~~and~~ Po, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Y, Zr,  
Nb, Mo, Tc, Ru, Rh, Pd, Ag, Cd, La, Hf, Ta, W, Re, Os, Ir, Pt, Au, Hg, Li,  
Na, K, Rb, Cs, Be, Mg, Ca, Sr, Ba, Ge, Si, Se, and Te.
29. (Original) The nanoreactor as claimed in claim 28, wherein the nanoparticle  
comprises Pt.
30. (Currently amended) A method of catalyzing a reaction, comprising:  
contacting one or more reactants with a nanoreactor ~~as claimed in claim 1~~, the  
nanoreactor comprising:  
a nanoreactor shell having a thickness of at least 0.5 nm,  
said nanoreactor shell enveloping a space, wherein,  
said nanoreactor shell is not perfectly single crystalline, further comprising  
a nanoparticle disposed within the space, wherein the nanoparticle is not a  
metal-chalcogenide semiconductor; and  
producing one or more reaction products.
31. (Currently amended) A method of hydrodesulfurization, comprising:  
contacting a compound comprising a thiophene moiety with a nanoreactor ~~as~~  
~~claimed in claim 11~~, the nanoreactor comprising:  
a nanoreactor shell having a thickness of at least 0.5 nm,  
said nanoreactor shell enveloping a space, wherein,  
said nanoreactor shell is not perfectly single crystalline, further comprising  
a nanoparticle disposed within the space, wherein the nanoparticle is not a  
metal-chalcogenide semiconductor; and  
producing one or more hydrodesulfurization products.